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# Sensory and emotional dimensions of domesticating new technology: an experiment with new e-bike users in Norway

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## ABSTRACT

Cities face major challenges when it comes to sustainability and mobility. Transport's contribution to climate change is well-established, and people need to move in the most sustainable way to reach the 2030 emissions targets set by the Paris Agreement. One possible pathway towards more sustainable mobility practices is electromobility. The electrification of micro-mobility is happening rapidly, and one of the most popular is the e-bike. For years, electric bikes were relegated to niche status, but they are now experiencing explosive growth in sales in many countries. In this article, we draw on an experiment with new users of e-bikes to study the integration of e-bikes into existing mobility practices and to explore their sustainability potential. Through the lens of domestication theory, we zoom in on the relations that formed between users, technology, and environments in the course of the experiment. Our analysis highlights how emotional and sensory experiences play crucial roles in the adaption of new mobility technologies. Based on our findings, we argue that to reach the sustainability potential of e-bikes, a set of support mechanisms must be developed according to a holistic and relational understanding of mobility that also takes emotions and sensory experiences into consideration.

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Mobility; domestication; sensory experiences; emotions; e-bike; sustainability transitions

## 1. Introduction

A recent IPCC report warns that 'widespread and rapid changes in the atmosphere, ocean, cryosphere, and biosphere have occurred' (Masson-Delmotte et al. 2021, 5), many of which are irreversible for centuries to come. To keep global warming below 1.5 °C and hence avoid its worst effects, greenhouse gas emissions need to be reduced by half by 2030, thus, requiring accelerated decarbonization (Goodwin 2021; Masson-Delmotte et al. 2021), which will entail deep and wide changes across all societal sectors. As Brand et al. (2020, 10) emphasize, 'the transport sector has a mammoth task ahead if this challenge is to be taken seriously'. The global transport sector is a major polluter. In 2020, it produced ~7.3 billion tons of CO<sub>2</sub> emissions, with passenger cars accounting for 41% (Tiseo 2021). Transitioning from fossil-fueled privately owned cars to alternative transport modes is thus a major challenge that must be met.

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In Norway, the climate challenge of private mobility has mainly been addressed through tax incentives to support the adaptation of electric cars. While this strategy has proven highly successful, a continued focus on private cars as the main mode of transport raises many concerns (Mersky et al. 2016; Figenbaum 2017). Electric cars still contribute to air pollution, they depend on the mining of scarce minerals which creates injustices along the value chain, and they are highly space demanding with roads and parking lots occupying large urban areas (Henderson 2020).

Rather than to promote private cars, we argue that cities need to rethink their mobility systems and engage their citizens in transforming their mobility practices. This entails facilitating deep changes in how mobility is organized. The question is: How can we get more people to leave their cars at home (or get rid of their cars completely) and instead bike, walk, or take public transport? To answer this, we need more knowledge about user perspectives and experiences. Based on an experiment with new users of electric bicycles (e-bikes) in Norway, this paper aims to contribute to addressing this question by focusing on: What makes the use of e-bikes attractive and viable for people (Kazemzadeh and Ronchi 2022), and what can we learn from people's e-bike experiences that are transferable to the societal adoption of other sustainable mobility technologies and practices?

Replacing private cars with e-bikes has great potential to contribute to lower transport emissions, particularly in urban areas. A recent study shows that e-bikes if used to replace car travel, have the capability to cut around 24 million tons of CO<sub>2</sub> emissions per year in England (Philips, Anable, and Chatterton 2022). In Norway, the larger cities have zero-growth targets for private car traffic, and the government accordingly aims to increase the share of bicycle rides to 20% in urban areas and 8% nationwide by 2030 (Samferdselsdepartementet 2021; Miljødirektoratet 2020). In 2019, only 4% of personal transport rides in Norway were undertaken by bicycle, whereas for the larger cities, the share of bike-rides was between 4% (Bergen) and 10% (Trondheim) (Statens Vegvesen 2020). Hence, the bicycle share in larger cities must at least double to reach the stated goals.

Indeed, in recent years the bicycle share in Norway's largest cities has increased. E-bikes especially have become more visible in the streets, with sales numbers more than doubling between 2017 and 2020 (Sandberg 2020). This rapid growth indicates that e-bikes cover the mobility needs of many citizens. Although they have a larger carbon footprint than regular bikes, in many Norwegian cities e-bikes appear to be the only viable biking option due to the mountainous terrain, and their potential for replacing car travel is therefore bigger (Fyhri and Sundfør 2020). E-bikes are thus seen as a potentially significant contributor to reaching the transport sector's climate goals, in addition to contributing to other areas, such as public health (Author 2021; Ydersbond and Veisten 2019; Philips, Anable, and Chatterton 2022). However, increased e-bike use is also associated with risks, such as accidents (Berk et al. 2022), environmental impact on the whole value chain (Kontar, Ahn, and Hicks 2022; Rose 2012), and socioeconomic inequality related to high prices (Wild, Woodward, and Shaw 2021). Policies should therefore take such risks into account and promote careful, responsible, and sustainable incorporation of technology into society (UNECE/WHO 2021; Solbu and Sørensen 2022).

To harvest the benefits, e-bikes are dependent on a wide adoption (Plazier, Witkamp, and Van Den Berg 2018; Cairns et al. 2017), and therefore 'interventions are essential to stimulate the upscaling and mainstreaming of this emerging low-energy transport mode' (Wikstrøm and Böcker 2020, 2). Current policy approaches to increasing the share of e-bikes in Norway focus mainly on infrastructural aspects, such as new bike lanes, parking, and charging facilities. Despite these interventions, cycling is still quite limited in most cities. Policy documents identify perceived costs, time, and reduced efficiency as main barriers to switching from cars to bikes and accordingly suggest information provision and awareness-raising measures to address the 'status quo-bias' of car drivers (Miljødirektoratet 2020; Nordengen et al. 2021; Samferdselsdepartementet 2021; Statens Vegvesen 2020).

In this paper, we focus on user interpretations and experiences of e-bikes. We explore what happened in the meeting between humans and technology when new users domesticated the

e-bike, that is, started to integrate the technology into their everyday lives. Although costs, time, and efficiency played a role in their experiences, the participants in our e-bike experiment emphasized the importance of sensory and emotional aspects of their e-bike experiences, which will be the main focus of this paper. Through that, we aim to broaden the perspective on mobility transitions and provide policymakers and practitioners with additional aspects to consider in mobility policies aimed towards shifting from cars to e-bikes in urban areas.

## 2. Theory: senses and emotions in the domestication of mobility technologies

In this paper, we study e-bike use through the lens of domestication theory to investigate how the e-bike is integrated into users' everyday practices (Silverstone and Hirsch 1992; Lie and Sørensen 1996). The study of how users integrate and use new technologies is an important field of research within Science and Technology Studies (STS). The concept of *domestication* has been used to address how people seemingly 'tame' technological objects by actively integrating them into their daily lives (Lie and Sørensen 1996). Through the process of domestication, new technologies are made part of everyday routines and habits, acquire new meanings and interpretations in relation to specific user contexts, and get incorporated into broader social practices (Sørensen, Aune, and Hatling 2000). Domestication also describes attempts to make technologies fit into their surroundings in a way that makes them invisible or taken for granted (Hynes and Richardson 2009). It is therefore useful to study how people construct new practices, needs, demands, and knowledge when they start using new technologies. What is constructed through the domestication process can be understood as the formation of a new 'micro-network of humans, artefacts, knowledge, and institutions' (Sørensen, Aune, and Hatling 2000, 241).

Sørensen, Aune, and Hatling (2000) argue that domestication can best be understood as a non-linear process consisting of three overlapping dimensions: the cognitive, the practical, and the symbolic. While the cognitive dimension describes processes of learning and developing the skills needed to use a new technology, the practical dimension refers to how users establish practices related to the technology and how they develop routines and institutions that support integration of the technology into everyday life. The symbolic dimension is about sensemaking and how users construct the meaning of a new technology and use the technology in constructing their own identities (Sørensen 2006). By studying the cognitive, practical, and symbolic dimensions of domestication as parallel processes, one avoids the deterministic position of merely studying the effects of technology as a purely social practice without a material context (Gromark et al. 2016).

In our analysis of e-bike users, we follow the three dimensions of domestication suggested by Sørensen, Aune, and Hatling (2000), but in addition, our main ambition is to explore emotional and sensory aspects, which have been barely studied in previous work on domestication. This interest aligns with what has been called the 'affective turn' (Clough and Halley 2007; Suominen, Silvast, and Harviainen 2018) in studies of relations between technology and humans and resonates with recent work in the expanding field from the sensory studies, which looks at how senses shape culture, society, and technology (Bull and Howes 2016; Sarıbaş and Demir 2020).

In domestication theory, however, little attention has been paid to such aspects. A notable exception is Lamvik's (1996) description of the emotional experience of the American car when driving past a mountain range in Norway:

I suddenly felt that there was an integral connection between the sunny weather, the landscape, the road, the music, the sound of the car, the soft springs, the other Amcars [American cars] behind and in front of me, the jeans I was wearing, the Zippo lighter on the dashboard. (Lamvik 1996, 168)

It was only when trying the car himself that this sensory experience of the network of humans, artefacts, knowledge, nature, and institutions emerged.

Other examples can be found within the Finnish strand of domestication theory (Hartmann 2020), which explicitly refers to sensations and emotions as part of the first phase of domesticating new technology (Pantzar 1997). Pantzar argues that new technologies represent something enjoyable, exciting, fascinating, and playful for people when they start using them. After a while, however, they lose their excitement and playfulness and become integrated into everyday life, or as Pantzar describes it, technologies go through a ‘metamorphosis... from “toys” to “instruments”, from “luxuries” to “necessities”, from “pleasure” to “comfort”, or from “sensation” to “routine”’ (Pantzar 1997, 54). Following this discussion, we argue that sensory and emotional aspects should be considered to a greater extent when studying the domestication of technology. With that, we also answer calls for further conceptual developments of domestication theory (e.g. Hartmann 2020).

We argued above that the climate crises require a fundamental transformation of our ways of life, including our mobility practices. Changing practices is not easy, however, and through our study of e-bike use, we explore how emotions and sensory aspects can take part in facilitating such change. Sahakian and Wilhite (2014, 28) refer to the ‘stubbornness of habits’ and see the body as one of the main pillars in the sedimentation of practices. Accordingly, Sahakian (2022) views things relating to the body, such as positive emotions about certain behaviors, as having the potential to challenge existing norms and routines and hence support transformation. Likewise, Weenink and Spargaren (2016, 3) argue that ‘[e]motions are connected to practices in a number of ways, and they provide (positive and negative) valences to both practices and their practitioners. In this way, emotions-in-practices help explain what matters to individuals and how they are set into motion by emotions’. Our study aims to extend the current understanding of domestication in this direction by investigating emotions and sensory experiences related to the use of e-bikes.

In the following, when we use the term *emotion*, we refer to the affective dimension of this complex and multifaceted concept, the subjectively experienced feelings which can be triggered by sensations. Further, we use the terms *sensation* and *sensory aspect* to describe the body’s ability to receive input from its surrounding environment, such as visual impressions from the landscape it is moving through, tactile experiences of materials, the feeling of air blowing on skin, and sensations of different types of smells and sounds.

Previous research has explored the relevance of emotion and sensation to the way people relate to and experience mobility. As Latour (2004, 205) puts it: ‘to have a body is to learn to be affected: meaning ‘effectuated’, moved, put into motion by other entities, human, or non-humans. If you are not engaged in this learning you become insensitive, dumb, you drop dead’. Other authors point to specific senses through which we experience the world. Jensen, Sheller, and Wind (2015, 364), state that it is through ‘our haptic sense of touch and our kinesthetic sense of bodily motion that we apprehend time and space, orient ourselves towards the world, and create place (and affect) through the frictions and rhythms of our movement through natural and built environments’.

Walking has been recognized as a way of touching and perceiving places (Rodaway 1994). When we walk through a city, our bodies connect with the environment and we ‘feel’ the city (Borer 2013). Spinney (2011) makes a similar point about cycling. One of his informants described a rewarding bike ride as ‘the feeling of speed on the straight, weaving through traffic, running a red light, doing a track stand, cornering, and moving across spatial boundaries to keep his “flow” going’ (Spinney 2011, 168). Adey (2009, 162) refers both to sensory and emotional experiences of mobility when writing that ‘as we can take mobility as something we feel according to our various capacities to perceive and sense, mobility is something which may be moved and something we might be moved on’. Hence, as humans, we are not only equipped with senses, such as sight, smell, taste, touch, and hearing, but we also interpret sensory impulses. We have emotions arising as responses to external stimuli, such as sensory experiences, and we have feelings as reactions to and conscious sensemaking of emotions.

Studies of e-bike use are still in their infancy and have only recently started to go beyond a focus on design, form, safety, sales trends, or environmental effects to address issues, such as travel behavior and user experiences (e.g. Fishman and Cherry 2016; Aldred 2015; Wild and Woodward 2019; Wolf and Seebauer 2014; Jones, Harms, and Heinen 2016; Behrendt 2018; Wikstrøm and Böcker 2020; Jensen, Sheller, and Wind 2015; Fyhri and Fearnley 2015). This literature already hints towards a potential role for sensory experiences and emotions.

Wild and Woodward (2019, 4) describe ‘high levels of “multi-sensory” activation, arising simultaneously from both inside and outside the body: combining internal sensations of muscular effort with sensory input from the landscape’. Examples of such sensations include feelings of speed, acceleration, and flow (Spinney 2011); more intense sounds, smells, and sights of the environment; and a reduction of sweat compared to regular biking (Wikstrøm and Böcker 2020). Wolf and Seebauer (2014) found that e-bike use was influenced by perceived benefits related to its comfort, while Jones, Harms, and Heinen (2016) found that e-bike users increased their level of physical activity because they experienced pleasure and joy when biking.

Users also describe e-biking as relaxing, creating calmness and stress relief, and liberating (Bhandal and Noonan 2022; Jensen, Sheller, and Wind 2015; Wikstrøm and Böcker 2020). Building on these studies that already point towards an important role of sensory and emotional aspects in people’s experiences of e-bike use, this paper aims to investigate further how sensory experiences in the context of mobility evoke different kinds of emotions.

This focus on senses and emotions stands in contrast to understandings of everyday mobility as something people do based on rational cost-benefit considerations (Jensen, Sheller, and Wind 2015) and to the framing of everyday mobility as a public health problem requiring ‘interventions’ to increase the amount of walking and cycling in a population (Carter, Green, and Speed 2018). E-biking should thus be understood as more than a ‘matter of utility’ or a ‘purely rational activity’ (Aldred 2015). Following Sheller and Urry (2006), we argue for a new mobility paradigm in which factors, such as materiality, culture, politics, practice, and learning as well as emotions and sensory aspects get more attention, rather than focusing merely on effectivization and optimization. We believe that such a perspective can create pathways to thinking differently about policy interventions, which in previous decades too often focused on marginal technological improvements and efficiency gains instead of substantial societal changes and which have shown limited effect in addressing sustainability challenges, often resulting in lock-ins and barriers to fundamental change (EEA 2021).

### 3. Methods

This paper is based on a research experiment with new users of e-bikes carried out in Trondheim, Norway between 2017 and 2019. The 19 study participants—whom themselves did not own e-bikes at that time—were given an e-bike for a period of two weeks. In-depth interviews were conducted with all participants both before and after the test period. The aim of the experiment was to understand how these unpracticed users of the technology domesticated the e-bikes and whether and how their mobility understandings, practices, and needs changed. Through confronting a new technology and testing, interpreting, and evaluating it, the participants provided valuable insight.

The participants were recruited using the snowball method, where initial participants were asked to refer other eligible participants who had never tried an e-bike before. None of the participants received any prior training or instruction on how to use the e-bikes before the study. The study participants were also contacted several months after the experiment to investigate how many had bought their own e-bikes. At that time, 13 of the 19 participants had bought their own e-bikes (Table 1).

**Table 1.** Overview of study participants.

Pseudonym and gender	Age	Everyday transportation	Purchase of e-bike after test period
Man (Arvid)	53	Car and bus	Yes
Girl (Sigrid)	15	Bus	Yes
Boy (Joakim)	13	Bus	Yes
Man (Geir)	28	Bus and bike	No
Woman (Maya)	29	Bus	Yes
Woman (Grete)	27	Bus	Yes
Man (Vemund)	30	Bus	Yes
Woman (Inger)	30	Bus	Yes
Woman (Sissel)	30	Car	Yes
Woman (Katrine)	34	Bus	No
Woman (Mari)	60	Car and bus	Yes
Woman (Tone)	49	Car	Yes
Woman (Agnes)	45	Car	Yes
Woman (Bjørghild)	60	Car	No
Man (Jomar)	56	Car	Yes
Woman (Sara)	21	Bus	No
Woman (Lissie)	22	Bus	No
Woman (Siv)	46	Car and walking	No
Boy (Tom)	16	Bus	Yes
N:19			

The age range of the participants was 13–60 years, and 13 women/girls and six men/boys participated. Of the 19 participants, five used a car as an everyday means of transport and three combined the car with bus, or walking. Ten participants relied only on the bus, and one combined bus use with bike use. While a few participants used bikes sporadically on weekdays, most characterized themselves as non-cyclists. The research experiment was conducted at the university in Trondheim; hence, most participants had a college or university education.

This qualitative study was exploratory and empirically driven, aiming to understand both experience and practice (Tjora 2017; Silverman 2020). We used an inductive strategy to analyse the data material. All interviews were recorded and transcribed, with study participants anonymized. The transcripts were thematically coded to bring out the essence of the data and to facilitate idea generation and theorization grounded in the empirical material. Although sensory experiences and emotions were not the focus of the experiment and the interviewer did not explicitly ask about these aspects, interviewees themselves emphasized the importance of sensory experiences and emotions when starting to integrate this new technology into their everyday lives. This triggered our research interest and motivated our engagement with domestication theory.

We are aware that experiments aimed at converting or transforming users into adopting sustainable behaviors, such as using e-bikes, can have several limitations. One of the main limitations is that they may not be representative of and inclusive to all population groups and hence, exclude certain groups, such as those with disabilities or low-income, or rural and elderly populations (Funk and Larsen 2021). Also, participants in our e-bike experiment represented a certain population group, highly educated middle-class citizens, which certainly presents a limitation of our study.

Another limitation is that experiments may not fully capture the real-world complexities and constraints (Funk and Larsen 2021). For example, an experiment in which participants test e-bikes for a short period of time may not fully reflect the long-term costs, maintenance requirements, or infrastructure limitations that individuals would face if they were to purchase and use an e-bike in “real life”. Furthermore, an experiment conducted in an urban context in Norway with good air quality, beautiful natural surroundings, low risk for accidents, and existing cycling infrastructure, is obviously not transferable to other urban contexts with more challenging cycling conditions and hence, other probably more negatively connotated sensory and emotional experiences of the e-bike technology.

## 4. Analysis of an e-bike experiment: sensing freedom, comfort, and joy

The rich accounts of our study participants' experiences with the e-bike demonstrate the complexity of its domestication. Our analysis aims to understand the domestication of the technology by focusing on the cognitive, practical, and symbolic dimensions of this process (Sørensen, Aune, and Hatling 2000). We first ask the questions: To what extent can we observe the development of new knowledge and skill sets in relation to the e-bike? To what extent did the use of the e-bike entail the participants establishing new practices and routines? How did the participants ascribe meaning to the e-bikes, and how was the e-bike part of shaping the identity of the participants? We then turn our attention to the role of sensory experiences and emotions in the domestication process. Here our objective is to explore and demonstrate the crucial role of sensations and emotions in the formation of relations between the users, the e-bikes, and the environment. The analysis is organized according to three themes: freedom, comfort, and speed.

### 4.1. Sensing freedom

New mobility technologies have traditionally been associated with ideas of freedom and the common assumptions that mobility equals freedom and that requires mobility (Sheller 2004). Stories interpreting mobility as liberating appear everywhere, from house, car, and vacation advertisements to political economic theory: 'We are always trying to get somewhere. No one wants to be stuck or bogged down' (Cresswell 2010, 21). When the car was first introduced in Norway and became widespread throughout the 1950s, freedom was an important symbolic meaning ascribed to the car, paralleling the zeitgeist of the era and supporting its integration (Sørensen 1992). In a practical sense, the car enabled people to travel independently; without reliance on public transport, they could reach new, unexplored destinations and gain control of their own mobility. This gave rise to completely new mobility practices and forms of societal organization (Sheller and Urry 2006).

In the same way, we find that our participants linked the e-bike to ideas of freedom of movement as its ease of use and flexibility enabled the users to incorporate the technology efficiently into daily life. This idea of freedom related to e-bike use was often contrasted with the experience of other mobility technologies, such as the car, public transport, and conventional bikes, as unfree. According to Sigrid, e-bike use led to freedom to decide when and where she could go: 'Freedom from taking a bus and such. (...) With an e-bike, it is probably only 5–10 min to school.'

Similarly, Inger explained the freedom she felt in being independent of the more strenuous modes of transport: 'I went to IKEA because it was easier. I can also ride with one hand. It is better to ride with this bike than to ask someone who owns a car or to take the bus.' She further explained how the e-bike expanded her geographical reach and rationalized her everyday activities: 'It gives me the freedom to come home to make dinner if I have an appointment at 19:00. Then I do not have to consider whether I can take the trip to friends after being home and eating dinner.' In this way, the e-bike was presented as a problem solver in everyday life, freeing our participants from previous mobility obstacles.

The domestication of the e-bike involved the cognitive dimensions in that it was dependent on learning how and when to use the e-bike, like finding new ways to solve daily mobility tasks. In a practical sense, the bike could thus be integrated into daily mobility practices and, importantly, be part of forming entirely new practices that were described as less dependent on car use or asking others for help. Symbolically, the e-bike was interpreted as a technology that represented freedom, and the e-bike took also part in shaping a user's identity as *being* more free.

We observed that the participants turned to a vocabulary marked by expressions of sensations and emotions when describing how the e-bike related to this notion of freedom. Sensations and emotions were intrinsically linked to the domestication process and woven into



how users made sense of the technology. Maya, e.g. made the following point about her embodied reaction to cycling an e-bike: 'I think I'm probably a little happier having my e-bike because I don't get so tired, and I don't have to use other means of transport'. She mentioned that even bad weather could be experienced as something positive when she rode an e-bike:

You can get far and at the same time have time to look around when riding an e-bike. Yesterday when I was riding the bike it was raining, I could actually look around and think that this is good, even when it's raining! I couldn't have done the same with a regular bike. On a regular bike, I'd just stare at the asphalt and look forward to coming home.

She thus emphasized freedom as a bodily sensation and as a condition for being able to do whatever she wanted to, without being controlled or limited. The practical aspect of saving time and energy by using an e-bike was accentuated by the ability to receive pleasing sensory information from the environment she was moving through.

Lissie compared these sensations to the closed-in feeling of sitting in a car: 'I got out, got some fresh air in my face and became active'. Lissie told her boyfriend, who had a car but used the bus due to expensive road tolls, about her e-bike experiences: 'I told him how proud I was that I had borrowed an electric bike for two weeks. He said that he wanted to do the same. He wanted to get to work in a different way'. The same interpretation was provided by Mari when she commented, 'It will replace the bicycle and partially the car'. The e-bike would replace the bike because she did not have the willpower to ride a regular bike and 'if the electric bike allows me to cycle to the shop instead of driving, that would be great'.

Controlling time was an important aspect of freedom, and this seemingly practical dimension was also closely tied to emotions and sensory experiences. The effectuated feeling of being in motion was an important experience for Maya: 'The e-bike can help me not to waste my life waiting for the bus'. Or as Tone said, if they had an e-bike, they 'would be out more and use the car to a much lesser extent, avoid the stress related to parking and instead walk straight into the forest'. When Maya was using the e-bike, she felt that: 'I'm on my way, I have more control and I do not have to calculate everything'. Tone pointed out that she 'avoid[s] the stress related to parking'.

Expressions, such as 'liberating', 'not wasting my life', and 'I am on my way' are all expressions related to sentiment, emotion, and social ordering of what 'good' time is (Freudendal-Pedersen 2017). In contrast, our participants felt bogged down when using their regular bikes. It was too time-consuming and exhausting to use to fulfill daily chores. Inger, who bought her own e-bike after the experiment but then saw it stolen after just a few months, used emotional expressions to explain the freedom that the e-bike represented for her:

When the bike was stolen, it was not just a bike that I lost, but it was a lifestyle and freedom that was robbed of me! The rhythm of everyday life was completely different. Instead of being a robot that mechanically goes to work, I felt that with the bike I produced energy—positive energy. Not to mention all the activities I had planned to do that did not materialize. Moving and cruising through the city gave me so much joy—but now it's gone!

Interestingly, we also observed that sensory experiences and emotions could be part of creating freedom from social norms. Geir experienced the e-bike as having good technical properties as well as helping challenge established normative practices. He explained:

When it comes to moving around the city, the electric bike is fantastic. I had a dream of getting out in nature, but none of my friends wanted to join. They only had regular bicycles. Another thing was that in the beginning, I was a little embarrassed by the sound the e-bike made, but then I talked to a friend who said: 'It's super cool, because it's so anti'.

This quote shows several interesting aspects of the domestication process. First, Geir claims that the e-bike had the advantage that he could get out more easily, but the technology also changed the dynamics associated with cycling with others, as Wikstrøm and Böcker (2020) have pointed out. Secondly, Geir interpreted the e-bike as an assistive technology that he was initially

ashamed of. However, through a conversation with a friend, the e-bike was domesticated as an antithesis to the authorities' attempts to promote the bike as a health and exercise technology. The sensory experience of the sound of the electric motor thus became a resource in crafting the user's identity. The e-bike represented much more than a training, health, and transport technology; it represented an enactment of being 'cool', which had obvious emotional dimensions.

The feeling of freedom was thus expressed in various ways. It can start with a cold breeze in the face creating a good and pleasant sensation which is interpreted as freedom. It can be linked to bodily sensations of movement through speed and an enlarged range—expanding the perception of what the body, mind, and technology are capable of. The absence of a sweaty shirt can be perceived as freedom from spending time dealing with smelling bad, showering, and needing to change clothes. That is, our participants domesticated not only the physical e-bike but also the experience of fluidity and movement; the e-bike was domesticated as something that produces emotions. As Stiegler, Sinding, and Greenberg (2019) explain, when we experience something as important to our needs, feelings are activated. These sensations and emotions of freedom appeared crucial for the integration of technology into the daily lives of our participants.

#### **4.2. Sensing comfort**

The ways that our participants talked about comfort further highlighted the importance of bodily sensations and tactile experiences in establishing a link with the e-bike. In its essence, comfort can be described as satisfaction with the relation between a body and its environment (Crowley 2001). The domestication of the e-bike can accordingly be understood as a process through which the participants make efforts to become comfortable. In a practical sense, this could involve adjusting the e-bikes to fit their bodies or making their mobility practices more comfortable by freeing themselves from the physical strains of travel. By presenting themselves as comfort-seeking individuals and using the e-bike to enact this identity, the participants showed how comfort was part of a reciprocal process of meaning-making between the technology and its users.

However, comfort was not just about the size of the e-bike, seat height, reach to the handlebars, or engine power. According to Stiegler, Sinding, and Greenberg (2019), emotions play out as sensations in the body, as various forms of comfort and discomfort. When it comes to the domestication of the e-bike, it is thus important to expand the understanding of comfort: it can apply to anything that encourages tranquility, well-being, or complacency as well as physical ease. Moreover, discomfort, such as pain, numbness, and tingling are important. While our participants often highlighted the comfort of using e-bikes, presenting the technology as something that could reduce the effort and discomfort they associated with other mobility technologies, their accounts drew on a variety of sensory and emotional aspects. As an example, Siv compared her e-bike experience to that of a regular bike:

I wanted it to be easier to motivate me to ride my bike to work and that happened, immediately. It was the hills that were tiring, but suddenly it got so easy. The landscape is transformed from Norway to Denmark, suddenly there are no hills, and the landscape unfolds. Hills no longer exist, just for the eye, not for the legs.

She explained further:

You don't think. For me the difference is that I don't think about whether I can ride a bike or not. It is nice to ride a bike, that's it. It's nice to go up the valley here, there are bird chirps, and you just sit treading easily. It is so ... pleasant.

She thus expressed an embodied, multifaceted domestication process in which touch, sound, and landscape intertwined. Importantly, comfort was interpreted in close relation to the aesthetic

experience of sensing her surroundings and feeling the speed and calmness of drifting with ease through the landscape. In a similar way, Inger compared the e-bike with biking in another country, linking its comfort to a feeling of nostalgia about previous positive cycling experiences: 'I felt like the e-bike was going to solve all my problems. I can ride here as I did in Amsterdam when I was an incredibly happy cyclist'.

Domestication theory can also be used to identify when something is *not* domesticated (Sørensen 2006; Hartmann 2020). Domestication is potentially conflictual as well as dynamic. One cannot expect stable closure of the distribution of meaning and practice related to an artefact. 'Practical routines of use may be broken, needs may change, relevant, external symbolic codes may be transformed, or the people involved may shift' (Sørensen 1994, 7). Some of our participants had dis-domesticated the regular bicycle; everyday chores put sticks in the wheels for its use. However, they now wanted to re-domesticate the bicycle, and they believed the e-bike could make this happen.

Arvid described that a change in his life situation made him stop cycling, but that the dream was still very much alive. He still considered himself a cyclist: 'In my soul, yes, but after I quit my previous job, everything has gone downhill. I cycled to work every day for over 4 years, summer and winter, and thought it was terrible. Then I changed job, and the times for delivering my kids to the kindergarten changed, so then I no longer biked, but in my soul, I am a cyclist'. Change in everyday rhythm was enough for Arvid to stop cycling and choose the car as means of transport. He bought an e-bike after the experiment.

Most participants also highlighted the absence of discomfort and the comfort of control when talking about their e-bike experiences. They mentioned that it helped them to overcome the stress and exhaustion of everyday mobility. Maya claimed that the e-bike made her mobile without requiring physical effort, making cycling a means of exploration rather than a means of exercise: 'I can take detours and do other things. I can explore more with this cycle'. This suggests that there is a potential user group of the e-bike consisting of people who are not interested in the bicycle as an exercise tool but want technology that is comfortable, convenient, and easy to use (see also Popovich et al. 2014; Ye, Xin, and Wei 2014).

Importantly, the drawbacks of other technologies, such as inconveniences with bus use or limited car mobility during rush hours, became an important context for a positive interpretation of the e-bike. Maya reflected on the need to use proper clothing when using the e-bike during bad weather: 'If the alternative is to be stuck in rush hour traffic, I would put on my rainwear and woolen shirt, too, and cycled most of the year'. Hence, in contrast to the interpretation of the regular bicycle as heavy, exhausting, and uncomfortable and the bus and car as inconvenient, crowded, and expensive, the e-bike was interpreted as a comfortable alternative. The use of e-bikes could thus help to re-domesticate cycling practices.

### **4.3. Sensing speed**

The speed of movement and time spent moving from A to B are crucial dimensions in the use of most mobility technologies, and 'time-saving' has been a key argument supporting the societal appropriation of the private car (e.g. Hagman 2003). We found similar accounts highlighting speed among our study participants and we already discussed this aspect of speed in relation to the themes of freedom and comfort above.

However, the e-bike's speed was also interpreted beyond practical utility. One key element in the experiences and sensations of speed was that it facilitated new relations and interactions with the environment. Our participants noted that as they moved more easily, their understanding and connection to their surroundings grew deeper and became more developed. By referring to the experience of navigating congested roads that limited the mobility of cars and the inconvenience of crowded buses with inflexible schedules, they perceived the e-bike's speed and

flexibility as advantages that enabled them to move smoothly and with ease through traffic, avoiding delays and arriving at their destination without any hassle. This also affected their overall experience of time in daily life.

Another aspect that was striking in how the participants reflected on speed was the experience of joy. The relationship between movement and joy is important. Joy can foster a sense of community, liberation, and empowerment (Winther 2014) but also aids in forming connections and building recognition, both in the physical body and in memories, as one actively engages with and experiences the environment through biking (Ingulfsvann, Moe, and Engelsrud 2022).

Many participants perceived e-biking as something totally different than normal cycling. Their stories were marked with references to spontaneous outbursts of excitement that in many instances were linked to the sense of speed. Agnes 'laughed down the slopes, it was such a good feeling. It was so fun and it was so easy—lovely feeling. The sense of speed, nature, and the smell was getting closer'. Hence, speed was not only about practicality or developing the cognitive skill set necessary to control the technology; it was just as much about the sense of speed as an embodied experience that drew the user, the technology, and the environment together. Through cycling, something happened both inside and outside the body—a multi-sensory activation (Wild and Woodward 2019) in which the combination of effort, landscape, and smells were united in a so-called sensescape (Jones 2012; Borer 2013). These observations are supported by previous research showing that one of the most typical emotional responses to e-biking is having fun (Wikstrøm and Böcker 2020).

Speed was also linked to other sensory and emotional experiences, such as competitiveness, as exemplified in Siv's account:

I also notice that I have a competitive instinct for wanting to ride the e-bike faster. It's one thing that you want to pass the other cyclists, but then it's also fantastic to ride past other e-bikers, I took myself to do that one day.

Agnes had a similar experience when it came to speed and competition, as she said:

I think it's nice with speed, I have a competitive instinct. I have been annoyed by everyone who cycled away from me up long steep hills. Now I keep up with the professional cyclists and it's an incredible feeling. I feel like a winner every day!

In this way the domestication of the e-bike tied into more complex emotions and social dynamics than just the pure enjoyment of the bike's technological properties. Competing with professional cyclists uphill gave Agnes a feeling of accomplishment. Importantly, the sense of speed was not only about speeding things up but could also be related to aspirations to slow down the pace of life. Agnes enjoyed overtaking other cyclists, but she also contemplated the possibilities of alternative mobility practices that could be enabled by the e-bike:

Pick flowers along the way, get a basket on the bike and get me a more comfortable bike seat. With the electric bike, you can go into new areas, go on a journey of discovery. In comparison to a car, you also get an experience, but if you drive yourself, you cannot capture much.

As illustrated by Agnes's description, the e-bike appears as a technology with a flexible temporality that allows for speed to be incorporated into the users' mobility practices in various ways. Drawing on this, the domestication of the e-bike became a process in which the users could re-think their existing habits, establish new relations between themselves, the technology, and the environment and construct entirely new mobility practices. This supports the potential of the e-bike to disrupt old and sedimented fossil-fuel based practices.

#### **4.4. Discussion: extending domestication theory**

Mobility is more than movement from A to B. As Cresswell (2006, 6, emphasis in original) puts it: 'What connects mobility at the scale of the body to mobility at other scales is *meaning*. Stories

about mobility, stories that are frequently ideological, connect blood cells to street patterns, reproduction to space travel'. In this paper, we used domestication theory with its three dimensions—practical, cognitive, and symbolic domestication (Sørensen 2006)—as an analytical framework to study how new users made sense of and integrated the e-bike into their everyday life. We found that the study participants engaged in domestication according to all three dimensions. They practically domesticated the e-bike by establishing new flexible, comfortable, and less car-dependent practices and routines. When using the e-bike they could take new roads, explore new areas of the city, and visit friends. They engaged in new ways of getting to work and leisure activities and found more practical ways to do shopping. The participants experienced that the e-bike almost 'drove' them to their destinations.

Cognitively, they domesticated the e-bike by developing new knowledge and skills regarding different aspects of its use, such as dealing with the battery, adjusting to different weather conditions, choosing what roads to take, and planning everyday activities. The e-bike experiment also inspired the participants to reflect more broadly on the e-bike, its use, and mobility transitions in general. Some mentioned, for example, that e-bikes could break their dependency on buses and cars. This relates to the symbolic dimension of domestication and how our study participants ascribed meaning to the e-bike. They interpreted the e-bike as something that could make them free, more efficient, and give them better comfort and a bigger range. They also interpreted e-bikes as a counterpoint against established identities of how cyclists are (sport cyclists), authorities' emphasis on health benefits, and car and bus dependency.

However, this did not tell us much about what triggered these interpretations. What caused an e-cyclist to start competing with sports cyclists? Or to cycle home after visiting the gym? These questions led us to highlight what emerged as an important factor in the accounts of our participants: their emphasis on emotions and sensory experiences. While the three dimensions of domestication are important analytical tools to describe what happens when people incorporate new technology into their everyday lives, we argue that the theory in its current form does not sufficiently capture the significance of emotional and sensory aspects. The symbolic dimension that concerns the construction of meaning and identity related to the technology could incorporate these aspects, but apart from a few notable exceptions that we mention in [section 2](#), few studies applying domestication theory have taken sensory and emotional dimensions into account.

In contrast, our study of e-bike users shows how the technology stimulated the sensory system in several ways. Our participants got closer and more connected to their surroundings, to people and nature through smell, sound, sight, and movement/speed when they rode an e-bike. They could have fun with the e-bike and it helped them be free from pain, sweat, and discomfort. They could compete, laugh, choose to speed up and down hills, ride a bike with one hand, and stop to look at a shop window, talk to someone, or pick flowers by the road. The experience of moving the body with an e-bike created a fuller embodied sense of mobility.

We argue that we need to take seriously such complexities of mobility practices (Adey 2017). Our study demonstrates the importance of incorporating emotions and sensory experiences to better understand what triggers the adaptation of new technologies. It points to how the three dimensions of the domestication theory framework, practical, cognitive, and symbolic, need to be complemented with an additional focus on emotions and sensory experiences. However, we do not view sensory experiences and emotions as a fourth dimension in the domestication framework but rather as underlying elements that support the formation of both practical use, skills and knowledge, and symbolic meanings across all three dimensions. These elements, as demonstrated by our study, need more explicit analytical attention within domestication studies as they can play an important part in successfully incorporating new technologies into society.

## 5. Conclusion

In this paper, we have examined the integration of e-bikes into everyday mobility practices based on an experiment with new users of the technology. The aim was to explore the potential of e-bikes as a contribution to sustainable mobility transitions in cities. Through the lens of domestication theory, we investigated the relations that formed between users, technology, and environments. While our analysis demonstrates cognitive, practical, and symbolic aspects of e-bike domestication, our participants emphasized sensory and emotional aspects as crucial to their experiences of the e-bike. We argue that these aspects need to be more explicitly addressed in studies of technology domestication.

We identified three key themes—freedom, comfort, and speed—through which our participants made sense of their e-bike experiences. Sensory experiences—touch, sound, smell, and sight—led to positive emotions of joy, happiness, pleasure, and excitement, which our participants interpreted as feeling free, comfortable, and fast. In contrast, other sustainable mobility technologies were interpreted as unfree, uncomfortable, and slow.

Interestingly, for many of our participants, e-bikes appeared as a viable alternative to private cars, which commonly are characterized by the same attributes: freedom, comfort, and speed. E-bikes satisfied practical needs; they were considered an efficient, fast, flexible, individualized, and comfortable mobility technology (perfectly in line with today's accelerated, individualized society). At the same time, e-bikes satisfied other needs related to experiencing nature and the environment, feeling calm and less stressed, and having small everyday adventures—needs that, according to our participants, the private car does not meet. Without exception, participants used positive attributes to describe the e-bike after the experiment.

We argue that policymakers and practitioners should pay more attention to emotional and sensory aspects when developing policies and measures aimed at encouraging people to change their mobility practices. Currently, Norwegian mobility policies focus on developing infrastructure and providing information to potential users to overcome the perceived barriers to switching transport modes: costs, time, and efficiency. The introduction of new technology and infrastructure is commonly based on efficiency considerations and the idea that it is most important to get people from A to B as quickly as possible. We argue that authorities should extend their focus beyond efficiency considerations.

In addition, we would like to direct attention towards the potential of experiments in sustainability transitions. After the e-bike experiment, two-thirds of the participants evaluated the e-bike as a technology that met their mobility needs to such a degree that they bought their own. This highlights the importance of more research on the role of experiments with citizens in everyday life settings. These experiments could, for example, communicate how easy, comfortable, fun, and sensuous it is to ride an e-bike or consider developing bike lanes in stimulating natural environments. As Adey (2017, 207) puts it: 'Engaging in the more than representational emotional and affective dimensions of mobility enables us to continue to move beyond the predominance of a singular mobile and rational individual'.

The latter claim by Adey ties our study to a broader discussion about creating spaces for deep and transformative change in mobility. Alternative technologies like e-bikes should not be part of a strategy of window-dressing, covering up the dominant, fossil-fuel based practices. In particular, the Norwegian public discourse on sustainability transitions has been marked by a series of paradoxes (Korsnes et al. 2023), triggered by a combined involvement in the oil- and gas industry and ambition to be a frontrunner in introducing new technologies to support domestic emission reductions. For the introduction of e-bikes to produce real climate impact, they cannot only be an addition to existing transport modes but must replace them. For this to happen, there is a need for ambitious policies to support market adaption, like we have witnessed with the successful introduction of electric cars through tax reductions, but also policies that integrate e-bikes into the broader context of city planning.

In this process towards reaching sustainable mobility transitions and successfully adapting new technologies and services, we thus argue that it is vital to take emotions into consideration. This is ‘particularly key in realizing that new technology may not work like old ones and can turn out to be different from what was expected, raising different emotional responses’ (Martiskainen and Sovacool 2021, 621). Emphasizing sensory experiences and feelings of freedom, comfort, joy, and speed in mobility policies could also contribute to other, more positive narratives about sustainability transitions that focus not only on restrictions but also on how a climate-friendly lifestyle can contribute to a better quality of life. The e-bike is a technology that can contribute to the transition to a more sustainable society and is perceived as both fun and pleasant, and this can be a viable pathway towards transformative change.

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